

Best Practices for Helping Governments Prioritize Equity in the Siting Electric Vehicle Infrastructure

TJ Pepping, Abt Associates
Lisa Grogan-McCulloch, Abt Associates
James Schroll, Abt Associates

ABSTRACT

For governments to achieve their climate goals, they must facilitate a transition from fossil fuel to electric vehicles (EVs). Access to EV charging is critical to enabling this transition and determining whether an individual will purchase an EV. In addition, as EV prices fall, they will become more accessible to low-income households. Unfortunately, access to EV charging is not distributed equally. While 80 percent of EV owners charge their vehicles at home, 50 percent of vehicles reside in multi-family unit dwellings (MUDs) where charging is less prevalent. Consequently, governments will need to provide public EV charging in low-income communities to meet the growing demand and ensure that communities reach their climate goals.

As governments plan for siting publicly accessible EV charging, they should incorporate equity considerations into their analyses. Overburdened communities are often exposed to multiple sources of pollution, including from vehicle emissions. Therefore, prioritizing EV charging locations in disadvantaged communities to expand EV ownership can reduce tailpipe emission exposure and the overall pollution burden in these communities.

This paper identifies best practices for how governments can use equity lenses to guide planning processes and provides examples of how cities have incorporated equity into EV guidance documents. The paper provides examples of how cities can evaluate aspects such as socio-economic factors, health indicators, environmental contaminant and pollutant exposure, land use, and the proximity of EV charging. Finally, the paper describes currently available tools that aggregate multiple indicators and exposure metrics.

Introduction

The transportation sector contributes more than a quarter (28) percent of the overall greenhouse gas (GHG) emissions in the United States (EPA 2020). As governments across the country implement climate plans to decarbonize the transportation sector, many governments are focusing on transitioning from internal combustion engine (ICE) to electric vehicles (EVs) to achieve their goals (Denver 2018).

EVs are projected to reach cost parity with ICE vehicles by 2025 (Hagerty, Sergici, and Lam 2020), therefore, there will be a growing demand for EV charging options. While the demand for EVs is projected to increase, to date, most of the EV ownership has been among richer households. In fact, 56 percent of the EV ownership has occurred within households making over \$100,000 per year (Muehlegger and Rapson 2019). Governments will be unable to achieve their ambitious climate goals unless they develop comprehensive plans to facilitate a transition to electric transportation for all demographic sectors, including low- and moderate-income (LMI) households and disadvantaged communities.

Currently, several barriers prevent low- and moderate-income and disadvantaged communities from adopting EVs. The first is the cost of EVs, which are higher than ICE vehicles. The second is the prevalence of EV charging infrastructure. While 80 percent of current EV owners report charging their vehicles at home (U.S. Department of Energy, Office of Energy Efficiency & Renewable Energy), approximately 50 percent of all vehicles in the United States reside in multifamily (SWEEP 2018). Low-income households are more likely to live in multifamily dwellings (NMHC 2019b) and have limited, if any, ability to modify their buildings to install EVSE (Cadmus 2018).

Therefore, as local governments develop policies siting future EV infrastructure, they should be mindful of how these decisions affect disadvantaged communities. It is critical that governments engage with disadvantaged and LMI communities to ensure that EV infrastructure can be sited in a way to promote future EV adoption. Disadvantaged and low-income communities bear a disproportionate amount of environmental burden, therefore, efforts to prioritize EV charging infrastructure in disadvantaged communities can help expand EV access and reduce the overall pollution burden in these communities by lowering tailpipe emissions.

The Cost of Electric Vehicles and LMI Vehicle Ownership

Given the current cost of EVs in comparison to ICE vehicles, the percentage of EV ownership among LMI households is relatively low (EIA 2018a). In addition, the federal tax credits for EVs (DOE n.d.) exclude most LMI households because they do not have the necessary tax liability (Panyam 2020). While some states, such as Connecticut (DEEP n.d.), have adopted programs to reduce the cost of EVs for LMI households, the cost of EVs remains a barrier to ownership, although EVs are projected to reach cost parity with ICE vehicles within the next four years (Hagerty, Sergici, and Lam 2020).

In addition, vehicle ownership is lower among poorer households, with 27 percent of households below the poverty line without a vehicle, compared to only 4 percent of households above the poverty line (Banerjee and Bricka 2018). In addition, vehicle age is higher among households with lower incomes. For households making less than \$25,000, the average vehicle age was 13 years, which is 40 percent older than households making more than \$100,000 (EIA 2018b).

Disadvantaged Communities Have Less Access To Off-Street EV Charging

Disadvantaged and low-income households face several challenges which result in less access to off-street EV charging than higher income households. First, while 80 percent of current EV owners report charging their vehicles at home (EERE n.d.), approximately 50 percent of all vehicles in the United States reside in MUDs (SWEEP 2018). Low-income households are more likely to live in apartments (NMHC 2019b) and approximately 45 percent of the rental households live in buildings with 5 or more units (NMHC 2019a). Residents of MUDs typically have less access to EV charging, referred to as EV supply equipment (EVSE) (Cadmus 2018). In addition, occupants of MUDs often have limited, if any, ability to modify their buildings to install EVSE (Cadmus 2018).

Access to EV charging is a vital factor in determining whether an individual will purchase an EV. In fact, according to surveys, the availability of charging is the third most important factor that determines if an individual will purchase an EV, behind cost and range (Coffman, Bernstein, and Wee 2015). Therefore, even if EVs reach cost parity with ICE

vehicles, unless there are efforts to expand EV charging for MUDs, then it would be unlikely for EV ownership to expand substantially within LMI households.

Environmental Burden Is Higher For Disadvantaged and LMI Communities

Historically, disadvantaged and low-income communities in the United States have faced an increased environmental burden from air pollutants, as these communities are often located near highways, making them more susceptible to vehicle emissions (Health Effects Institute 2010). Although definitions differ among agencies and states, disadvantaged communities or “underserved communities” are often defined as areas with lower incomes (either below the poverty line or below the area median income), higher percentages of minorities, and with limited English language proficiency (Ezike, Tatian, and Velasco 2020). The Federal Highway Administration (FHWA), as articulated in Executive Order 6640.23A, identifies disadvantaged communities, or those disproportionately affected by the adverse environmental impacts, as those communities where minority or low-income communities suffer more than nonminority or higher-income populations (FHWA 2015). The U.S. Department of Housing and Urban Development (HUD) defines low-income as up to 50 percent of Area Median Income (AMI) and moderate-income as greater than 50 percent and up to 80 percent of AMI (HUD 2021).

Studies have shown that communities of color have faced a higher risk of premature death than whites regardless of income (Di et. al 2017). In addition, research has shown that lower income communities face higher instances of premature death due to poor air quality (Zeger, Dominici, McDermott, and Samet 2008). Overall, the increased environmental burden on disadvantaged communities can lead to the higher propensity of disease and premature death (American Lung Association n.d.), including from COVID-19 (Petroni et al. 2020).

As governments develop policies to reduce transportation emissions through a transition to electrification, it is important that overly burdened communities benefit from those reductions. Efforts to mitigate additional emissions, such as the expansion of EV infrastructure, should be done equitably to reduce the burden on the most vulnerable communities and should not further existing inequalities (EEJWG 2020).

Disadvantaged Communities Historically Have Had Less Access To Planning Processes

While communities are starting to be more intentional about addressing issues of environmental justice, disadvantaged communities historically have had less access to planning processes (Ezike, Tatian, and Velasco 2020). Driven by federal subsidies, federal and state transportation officials planned new highways through existing minority communities, displacing these residents with little or no opportunity to participate in the process (Ezike, Tatian, and Velasco 2020).

The adoption of Title VI of the Civil Rights Act of 1964 stipulated that people could not be excluded from federal assistance on the grounds of “race, color, or national origin” (FTA n.d.). President Clinton’s issuance of Executive Order 12898 (DOT n.d.), expanded the Title VI requirements by forcing state transportation agencies and metropolitan planning organizations (MPOs) to identify minority and low-income populations, and evaluate environmental racism in their planning processes (Ezike, Tatian, and Velasco 2020). Although the law required state agencies and MPOs to define disadvantaged communities and address how policies may affect these populations disproportionately, state agencies and MPOs take different approaches to

identifying these communities (Ezike, Tatian, and Velasco 2020). Therefore, there is not a standard practice for including marginalized communities in planning processes.

Best Practices In Prioritizing Equity In Siting EV Infrastructure

As governments develop plans for the siting of EVSE infrastructure, they should consider the following best practices for incorporating equity in the planning process. Local governments can also develop or use tools that incorporate block-level data, such as emissions exposure, to help the government evaluate the impacts of EVSE siting decisions on future emissions.

Include Disadvantaged Communities in The Planning Process

As governments develop plans for siting and installing publicly accessible EVSE, they should be intentional about including disadvantaged communities. Local governments can establish a baseline for public participation by implementing the International Association for Public Participation's Core Values which are developed to be inclusive of all communities and cultures (IAP2 n.d.). Governments can build on this public engagement baseline by adopting public participation principles that ensure that planning processes are transparent and accessible to diverse populations (EEJWG 2020).

Local governments should be aware that levels of education, literacy, or English language comprehension may be lower among disadvantaged communities. As governments develop outreach strategies to include marginalized communities, staff should ensure that materials limit or avoid the use of acronyms where possible and language is simplified to ensure broad understanding (SCAG 2020). Government staff could consider having outreach materials translated into other prevalent languages in the community to allow those without English proficiency to provide input (SCAG 2020).

In addition, governments can also develop processes to evaluate to how and to what extent equity had been incorporated into planning processes. For example, governments could develop tools similar to the Initiative for Energy Justice's Energy Justice Scorecard, which helps policymakers determine the extent to which marginalized communities were included meaningfully in planning processes and whether policy remedies could disproportionately affect disadvantaged communities (Initiative for Energy Justice 2019).

Develop EV Plans That Prioritize Equity

Local governments can create specific planning documents to facilitate the expansion of EVSE and can incorporate equity into these plans. For example, Denver's Electric Vehicle Action Plan notes how Denver could install EVSE at park-n-ride facilities, which could assist underserved communities in multi-family housing (Denver 2020a). By highlighting the ways in which the location of EVSE can help overburdened communities, cities can help expand EVSE, while understanding the key role it can play in addressing existing disparities.

In Seattle's EVSE Roadmap for Shared Mobility Hubs, the city's Department of Transportation highlights the need to address concerns of equity specifically in section five of the document (Seattle Department of Transportation 2018). Specifically, the Roadmap notes that the city should engage with disadvantaged communities about the benefits of electric transportation and highlights the need to establish good forms of communication with community members (Seattle Department of Transportation 2018). In addition, the Roadmap references the need to

engage key stakeholders to gather information to identify future sites for EVSE, while mitigating the displacement of existing on-street parking (Seattle Department of Transportation 2018).

Use Neighborhood-Specific Data To Evaluate Benefits Associated With EVSE Siting

Governments can use block-level data to develop tools to identify locations within their communities where increased electric vehicle travel may have more health and societal benefits. Denver’s EV Action Plan incorporates Denver’s Neighborhood Equity Index (shown in Figure 1), which can help Denver evaluate which sites would benefit more from access to EV charging infrastructure (Denver 2020b). The Index is derived by average ranking data across five sub-indices: socioeconomics, the built environment, access to care, morbidity, and mortality (Denver 2020b). The Denver government and other decision-makers can analyze the aggregate Equity Index or analyze each sub-index (Denver 2020b).

As governments consider developing plans for the siting of EVSE, they can consider developing their own indices that would allow for the analysis at the Census tract or block level. Specifically, they could consider developing sub-indices on socio-economic factors (e.g., income), health indicators (e.g., instances of respiratory illness), emissions exposure (e.g., areas with high PM_{2.5} emissions), land use and zoning (e.g., areas with high rates of multi-family dwellings), and the proximity of nearby EV charging.

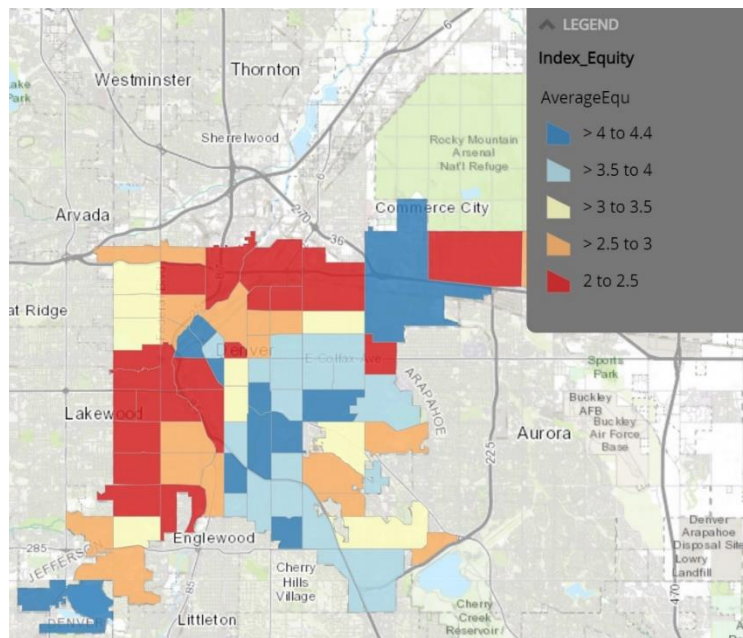


Figure 1. Denver Neighborhood Equity Index. Source: Denver 2020b.

Continue To Prioritize Investment In Transit And Active Transportation

While governments should develop plans and policies to increase publicly accessible EVSE, especially in disadvantaged communities, governments should continue to make investments in other transportation options, particularly transit. For many disadvantaged communities, transit is more accessible than electric vehicles, given the existing cost of EVs. In addition, transit can reduce emissions for overburdened communities (EEJWG 2020).

The condition of a neighborhood's built environment can play a critical role in determining the amount of active transportation, such as walking and biking (Sallis et al. 2009). Pedestrian infrastructure (e.g., sidewalks) are less prevalent in low-income neighborhoods (Bridging the Gap 2012), which leads to higher pedestrian fatalities (Maciag 2014). Therefore, improvements to pedestrian infrastructure can improve pedestrian safety significantly and increase walkability. In addition, an increase in active transportation can further reduce the burden on marginalized communities.

How State & Local Governments Have Incorporated Equity Into Plans

Use of Volkswagen Settlement Funds to Expand EV Infrastructure

For states, the largest dedicated source of public funding for transportation electrification investment is from the 2016 Volkswagen (VW) Settlement. As part of the settlement, VW was required to establish the Environmental Mitigation Trust Fund containing nearly \$3 billion to be allocated to states for investment in clean on- and off-road vehicles designed to reduce nitrogen oxide (NOx) emissions from medium- and heavy-duty sources and light-duty electric vehicle charging infrastructure. As part of Colorado's 2018 electric vehicle plan, the state dedicated all remaining VW settlement funds to ZEV charging infrastructure and zero emission buses, shuttles and trucks including first round grant awards totaling \$13.9 million to six transit agencies for 23 battery electric buses and supporting infrastructure. Additionally, Colorado has required that all transportation electrification programs be designed in a way that supports underserved communities (Smith 2020a).

As of July 2020, approximately 80% of the VS settlement money had not been allocated. This presents a significant opportunity for states to expand EV infrastructure in an equitable manner (Smith 2020a). Below we present some examples of state and local governments that have used equity lenses to improve public engagement strategies around decision-making processes, such as the planning for the future siting of EV infrastructure. Communities have created frameworks and principles which can inform public participation and hold communities accountable for ensuring that equity is a key focus. In addition, governments have incorporated equity frameworks into EV infrastructure development plans to identify how certain sites may affect disadvantaged communities.

Connecticut's Efforts to Incorporate Equity into Planning Processes

A Connecticut Executive Order issued in 2019 established the Governor's Council on Climate Change and directed the Council to analyze both climate mitigation progress and climate change adaptation through an equity lens (State of Connecticut 2019). In a 2020 report (EEJWG 2020), the Connecticut Equity & Environmental Justice Working Group developed a Public Participation Guidance outlining how to engage the public throughout policymaking and policy implementation. The guidance takes into account several resources including EPA's Title VI Public Involvement Guidance (EPA 2013) and is organized according to four principles necessary for fair public participation (see Table 1). For each principle, in addition to the guiding questions shown below, the guidance includes specific actions to be taken to create a more open, accessible, transparent, and accountable public participation process.

Table 1. Connecticut's Principles for Public Participation.

Principles for Public Participation	Participation Guiding Question to Hold Ourselves Accountable
Transparent and Accountable Decision-Making	<ul style="list-style-type: none"> • Is decision-making open, transparent, and accountable to the public at all stages?
Accessible and Inclusive Decision-Making	<ul style="list-style-type: none"> • Is the decision-making process accessible to and inclusive of diverse populations? • Are we ensuring that members from historically disadvantaged communities – including communities of color, communities that are economically disadvantaged, people with disabilities, and others are fully participating?
Equal Partnerships, Co-Production, and Self-Determination	<ul style="list-style-type: none"> • Are community members equal partners in decision-making? • Are we asking communities for their equal input and creating policies with them rather than for them?
Respect, Efficiency, and Non-Exploitation	<ul style="list-style-type: none"> • Is the decision-making process respectful and streamlined to ensure the time and effort of participants is valued?

Source: EEJWG 2020.

City of Seattle’s Immigrant and Refugee Engagement

The City of Seattle recently engaged with immigrant and refugee community members and leaders to help adapt its electrification of transportation program in an equitable and inclusive way. The city convened and partnered with different immigrant and refugee groups to begin the conversation around what electrification of the transportation sector means to communities and what priorities the city should focus on with regard to this issue (ECOSS 2019). The engagement included a combination of information sessions, participation in community gatherings, and interviews with community leaders representing various communities. The communities’ feedback centered around the need to develop educational programs on the importance of electrification of transportation (ECOSS 2019). Other concerns included reliability and affordability across communities in terms of electricity price hikes, EV’s cost and general transportation cost increases, and the need to expand affordable car sharing programs in different neighborhoods (ECOSS 2019).

Denver’s Electric Vehicle Action Plan

The City and County of Denver recently considered equitable outcomes when developing its 2020 Electric Vehicle Action Plan (Denver 2020a), which sets a pace for EV adoption in Denver. The plan considered equitable outcomes of the plan related to affordability, access, economic empowerment, inclusion, and accountability. They considered both positive and

negative impacts and adjusted the priority of actions based on their impacts to equity (Denver 2020a). Table 2 below summarizes the framework they used to assess the impacts of their plan.

Table 2. Denver’s Electric Vehicle Action Plan Equity Framework

Outcome Area	Potential Impact Questions
Affordability: Could this action...	<ul style="list-style-type: none"> • Decrease the cost of EV ownership or use for underserved Denver residents? • Prioritize financing for income-burdened populations? • Reduce the number of families cost burdened by housing or transportation?
Access: Could this action...	<ul style="list-style-type: none"> • Increase access to charging infrastructure for marginalized communities? • Increase access to healthy food? • Expand access to healthy or clean transport systems? • Increase access to parks? • Increase access to essential services (hospitals, fire, police)?
Economic Empowerment: Could this action...	<ul style="list-style-type: none"> • Increase opportunities for living wage jobs? • Provide a just transition for jobs or industries negatively affected by decreased ICE use? • Advance educational quality and access?
Inclusion and Accountability: Could this action...	<ul style="list-style-type: none"> • Generate burdens (including costs), either directly or indirectly, to marginalized groups? • Target benefits in progressive ways to reduce historical or current disparities? • Engage and empower marginalized groups in a meaningful and culturally appropriate manner?

Source: Denver 2020a.

Minneapolis’ Green Cost Sharing Program

The City of Minneapolis provides a Green Cost Sharing program that allocates matching funds for building projects with energy reduction, solar, or pollution prevention components (Minneapolis n.d.). In order to promote equity and help focus funds on projects in areas with pre-existing socioeconomic and pollution burdens, Minneapolis automatically designates projects in these “Green Zones” as eligible for priority funding in the program (Kresge 2021). The original idea for developing Green Zones to help better support disadvantaged communities was created by an environmental justice working group under the city’s Climate Action Plan (Minneapolis n.d.).

Existing Tools

Although there is still much work to be done to incorporate environmental equity into programs and policies, there are many tools already available which provide relevant data sets

that can be used to help inform decision-making and target resources in communities. The tools can be applied to the challenges and logistics in identifying locations for new EV charging stations. For example, geospatial analyses can help to flag locations that ensure all members of a community are within a certain distance of at least one EV charging site while prioritizing locations based on demographic indicators, such as percentage of the population that is low income, and environmental considerations, such as poor air quality.

Environmental And Demographic Indicator Datasets

One of the primary resources available at the national level is EPA's EJSCREEN tool (EPA n.d.), which provides a robust mapping interface to help visualize demographic and environmental indicators in communities across the entire country. The mapping and screening tool includes many datasets based on the Census block group level and is designed using an interactive and publicly accessible GIS mapping platform. EJSCREEN includes a suite of demographic indicators, such as low income and people of color, as well as environmental indicators that consider the burden from pollutants such as PM_{2.5} and related impacts such as traffic proximity and proximity to Superfund sites (EPA n.d.). EJSCREEN allows the user to add other sources of data, such as charging station locations in the Washington, D.C. area (MWCOC n.d.).

In the example shown in *Figure 2*, many neighborhoods in Washington, D.C.'s northeast quadrant score high on an index that considers traffic proximity and volume, demographics based on people of color and low-income residents, and the overall population. However, only one charging station is in this part of the city, whereas dozens are located in parts of the northwest quadrant that score much lower on this index. Similar approaches to visualizing locations where actions can be taken to address disparities in access to EV infrastructure in other communities across the country.

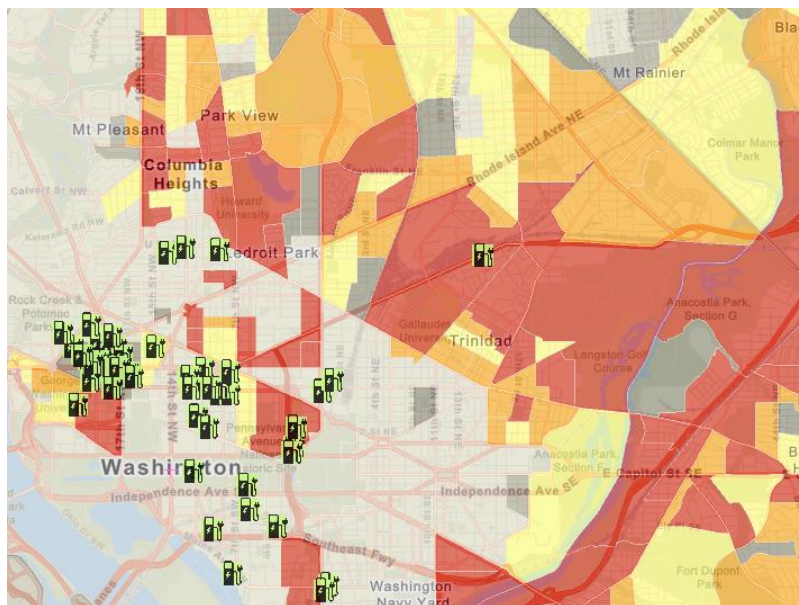


Figure 2. EJSCREEN map of traffic proximity/demographic index indicator and EV charging station locations in Washington, D.C.

Source: <https://ejscreen.epa.gov/mapper/>

California's Office of Environmental Health Hazard Assessment develops a similar tool called CalEnviroScreen that incorporates many of the same environmental and demographic indicators, but also aggregates all the different indicators into a score metric that can be used to visualize cumulative impacts in California communities by Census tract (California Office of Environmental Health Hazard Assessment n.d.). This score can then be used to compare communities across the state and better understand the cumulative potential burden from environmental pollutants and related socioeconomic and health considerations. Other tools for better understanding socioeconomic data at the neighborhood level are also available for many other communities nationwide. For example, the Greenlink Equity Map (GEM) offers policymakers and community organizers a tool for visualizing how 20 different indicators related to demographics, health, housing, income, technology and utility burden vary at the Census tract level (Greenlink Analytics 2020). The goal of the GEM developers is for this mapping tool and accompanying process guide to help cities to identify more equitable solutions when developing local climate and energy policy through a deeper understanding of the community and existing inequities.

Expanding the use and capabilities of screening and mapping tools is currently a focus on addressing environmental equity concerns across all types of policy decisions for multiple parts of the federal government. For example, legislation proposed in Congress outlines potential indicators to add into EJSCREEN such as high rent burden, rates of diabetes, and pollution from per- and polyfluoroalkyl substances (PFAS) in the community (Markey 2021). This same legislation proposes to identify a methodology for adopting a cumulative impact framework, like CalEnviroScreen. From the executive branch, EJSCREEN has already been flagged by the new Biden administration as a starting point for developing a new Climate and Environmental Justice Screening Tool that would be used to "identify disadvantaged communities...and inform equitable decision making across the federal government" (White House 2021).

EJSCREEN and related tools, especially as they expand to include additional datasets and features, could be used to inform policy decisions related to EV charging locations, such as the example described in *Figure 2*. However, while this can help to identify locations and communities that would benefit most greatly from EV charging locations, there are still outstanding questions about how best to introduce and develop EV charging infrastructure in communities around the country.

Guidelines For Incorporating Equity Into Electric Mobility

Various resources seek to highlight and resolve the issues related to successfully introducing electric mobility into communities across the country, including concerns about equity. How equity is defined, and the challenges in incorporating equity to decision making, will be different across the country. Established guidelines and best practices can help policymakers to incorporate these considerations based on the needs of their community.

For example, GridForward provides a framework for introducing EV infrastructure by focusing on engaging with members of community throughout the process and ensuring that overburdened communities are prioritized (Smith 2020b). Other groups, such as the International Council on Clean Transportation (ICCT), have developed similar materials suggesting best practices for expanding e-mobility access. A briefing from ICCT summarizes how a suite of policies or actions to expand e-mobility access addresses issues related to affordability, practicality, and awareness, as well as the relevance to different groups of policymakers such as state and local governments, non-profits, and utilities (ICCT 2017). Some of these policies are

geared towards underserved communities, such as developing financial incentives like tax rebates for low-income households to purchase EVs.

The infrastructure for expanding EV use and the considerations related to equity go beyond just the cars and charging stations. Greenlining's "Electric Vehicles for All: An Equity Toolkit" highlights some of the other factors that can hinder or exacerbate e-mobility. These include increasing awareness of EVs and addressing misconceptions about range and incentivizing car dealerships to sell EVs, particularly in low-income communities (Greenlining Institute 2016). Addressing these factors through targeted policies, outreach campaigns, and other strategies could help residents who are typically underserved to become more inclined to purchasing EVs and help promote more widespread adoption of the technology.

Focusing only on equity may also distract from additional challenges in specific communities. For example, densely populated urban communities will need to identify how best to provide publicly accessible charging stations to support shared on-street parking. A report from the State of New York identifies the logistical issues specific to on-street parking in a metropolitan area like New York and provides guidelines for introducing curbside charging (NYSERDA 2019). A balanced approach between fair and practical can help to ensure a successful expansion of e-mobility access in the U.S. while prioritizing communities and stakeholders that have fewer resources to adapt on their own.

Future Research

As the price of EVs falls and the number of EVs grows over the next five to six years (Hagerty, Sergici, and Lam 2020), governments will need additional research, tools, and guidance to ensure that the siting of EVSE is equitable and helps to reduce the environmental burden on disadvantaged communities.

Accessibility By The Disabled

In addition to evaluating how local governments can consider incorporating issues of equity with respect to household income, local governments should ensure that future codes and ordinances provide accessible EV parking spaces for individuals with disabilities. While there are no federal EV parking standards, states, such as California (California Division of the State Architect 2017) and councils of government (ECOTality North America 2011) have developed guidelines regarding the design of accessible EV parking spaces. Additional guidance could be provided to ensure that EVSE are accessible to all users.

Improvements To EPA's EJSCREEN Tool

Additional research could be done to identify opportunities to improve EPA's EJSCREEN mapping tool to make it more robust and helpful for planning processes. While EJSCREEN offers users the ability to analyze important variables, such as the location of minority populations, the tool does not allow for mapping multiple datasets simultaneously. This limitation hinders the ability of the tool to consider the impact of several underlying factors. The research could also help EPA better understand the intersection between the environment, health outcomes, and our communities.

Conclusion

As EVs reach cost parity with ICE vehicles within the coming decade, it will be incumbent on governments to develop policy frameworks and plans that incorporate equity lenses. Through these efforts, governments can facilitate the expansion of EV infrastructure, while lowering the environmental burden on overburdened, marginalized communities.

References

- American Lung Association. n.d. “Disparities in the Impact of Air Pollution.”
<https://www.lung.org/clean-air/outdoors/who-is-at-risk/disparities>.
- Banerjee, A., and S. Bricka. 2018. “Travel Patterns of the Low Income.”
<http://onlinepubs.trb.org/onlinepubs/Conferences/2018/NHTS/BanerjeeTravelPatternsofLowIncomeHouseholds.pdf>.
- Bridging the Gap. 2012. “Income Disparities in Street Features that Encourage Walking.”
http://www.bridgingthegapresearch.org/_asset/02fpi3/btg_street_walkability_FINAL_03-09-12.pdf.
- Cadmus. 2018. “Pathways to EV: Preparing cities for the transition to electric vehicles.”
<https://www.mwcog.org/file.aspx?&A=%2FcbHBRktbiMwf59mPQ7bTFjMU%2BMYsk8soGQw1lpc1IE%3D>.
- California Division of the State Architect, Department of General Services. 2017. New Accessibility Regulations for Electric Vehicle Charging Stations. https://www.dgs.ca.gov/-/media/Divisions/DSA/Publications/access/EVCSPresentation_04-07-17pt.pptx?la=en&hash=19DF90753D3FD52D43BB88881A34DC27D3A05151.
- California’s Office of Environmental Health Hazard Assessment. n.d. “CalEnviroScreen.”
<https://oehha.ca.gov/calenviroscreen>.
- Coffman, M., P. Bernstein, and S. Wee. 2015. “Factors Affecting EV Adoption: A Literature Review and EV Forecast for Hawaii.” *Electric Vehicle Transportation Center*. Honolulu, HI.
<http://evtc.fsec.ucf.edu/publications/documents/HNEI-04-15.pdf>.
- Denver (City and County of Denver, CO). 2018. “80 x 50 Climate Action Plan.”
https://www.denvergov.org/files/assets/public/climate-action/documents/ddphe_80x50_climateactionplan.pdf.
- .2020a. “Denver Electric Vehicle Plan.”
<https://www.denvergov.org/content/dam/denvergov/Portals/779/documents/transportation/DenverVehicleElectrificationActionPlan.pdf>.
- .2020b. “Denver Neighborhood Equity Index.”
<https://www.arcgis.com/apps/MapJournal/index.html?appid=2f30c73e83204e96824a14680a62a18e>.

- DEEP (Department of Energy and Environmental Protection, State of Connecticut). n.d. “Connecticut Hydrogen and Electric Automobile Purchase Rebate (CHEAPR).” <https://portal.ct.gov/DEEP/Air/Mobile-Sources/CHEAPR/CHEAPR---Home>.
- DOE (U.S. Department of Energy). n.d. “Federal Tax Credits for New All-Electric and Plug-in Hybrid Vehicles.” <https://www.fueleconomy.gov/feg/taxevb.shtml>.
- DOT (U.S. Department of Transportation). n.d. “Department of Transportation Order 5610.2(a): Final DOT Environmental Justice Order.” <https://www.transportation.gov/transportation-policy/environmental-justice/departement-transportation-order-56102a>.
- Di, Q., Y. Wang, A. Zanobetti, P. Koutrakis, C. Choirat, F. Dominici, J. Schwartz. 2017. “Air Pollution and Mortality in the Medicare Population.” *New England Journal of Medicine*. 376:2513-2522. <https://www.nejm.org/doi/full/10.1056/nejmoal702747>
- ECOSS. 2019. “Drive Clean Seattle 2019 Equity Outreach: Final Report.” <https://www.seattle.gov/Documents/Departments/OSE/ClimateDocs/TE/Drive%20Clean%20Seattle%202019%20Equity%20Outreach%20Final%20Report.docx.pdf>
- ECotality North America. 2011. “Lessons Learned – EV Project: Accessibility at Public Charging Locations.” <https://www.mwcog.org/file.aspx?A=mMhGUHJeFifRxpPU8BCxkoB62b%2FGNgLJBKcNRqzvsc8%3D>.
- EEJWG (State of Connecticut’s Equity & Environmental Justice Working Group). 2020. “Equity & Environmental Justice Working Group Report: Prepared for the Governor’s Council on Climate Change.” https://portal.ct.gov/-/media/DEEP/climatechange/GC3/GC3-working-group-reports/GC3_Equity_EJ_Final_Report_111320.pdf.
- EERE (U.S. Department of Energy, Office of Energy Efficiency & Renewable Energy). n.d. “Charging at Home: Electric Vehicles.” <https://www.energy.gov/eere/electricvehicles/charging-home>.
- EIA (U.S. Energy Information Administration). 2018a. “Electrified vehicles continue to see slow growth and less use than conventional vehicles.” <https://www.eia.gov/todayinenergy/detail.php?id=36312>.
- . 2018b. “U.S. households are holding on to their vehicles longer.” <https://www.eia.gov/todayinenergy/detail.php?id=36914>.
- EPA (U.S. Environmental Protection Agency). n.d. “EJSCREEN: Environmental Justice Screening and Mapping Tool.” <https://www.epa.gov/ejscreen>.
- . 2013. “Title VI Public Involvement Guidance for EPA Assistance Recipients Administering Environmental Permitting Programs (Recipient Guidance).” *Federal Register*. Vol. 71, No. 54. https://www.epa.gov/sites/production/files/2013-09/documents/title6_public_involvement_guidance.3.13.13.pdf.

- . 2020. “Fast Facts on Transportation Greenhouse Gas Emissions.” <https://www.epa.gov/greenvehicles/fast-facts-transportation-greenhouse-gas-emissions>.
- Ezike, R, P. Tatian, and G. Velasco. 2020. “Defining “Communities of Concern” in Transportation Planning: A Review of How Planners Identify Underserved Communities.” *Urban Institute*. Washington, DC. https://www.urban.org/sites/default/files/publication/102746/defining-communities-of-concern-in-transportation-planning_1.pdf.
- FHWA (Federal Highway Administration). 2015. “Environmental Justice Reference Guide.” http://fhwa.dot.gov/environment/environmental_justice/publications/reference_guide_2015/fhwahep15035.pdf.
- FTA (U.S. Department of Transportation, Federal Transit Administration). n.d. “Title VI of the Civil Rights Act of 1964.” <https://www.transit.dot.gov/title6>.
- Greenlink Analytics. 2020. “Greenlink Equity Map.” <https://www.equitymap.org/>.
- Greenlining Institute. 2016. “Electric Vehicles for All: An Equity Toolkit.” <https://greenlining.org/publications/online-resources/2016/electric-vehicles-equity-toolkit/>.
- Hagerty, M., S. Sergici, and L. Lam. 2020. “Getting to 20 Million EVs by 2030: Opportunities for Electricity Industry in Preparing for an EV Future.” Brattle Group. Washington, DC. https://brattlefiles.blob.core.windows.net/files/19421_brattle_-_opportunities_for_the_electricity_industry_in_ev_transition_-_final.pdf.
- Health Effects Institute. 2010. “Traffic Related Pollution: A Critical Review of the Literature on Emissions, Exposure, and Health Effects.” <https://www.healtheffects.org/publication/traffic-related-air-pollution-critical-review-literature-emissions-exposure-and-health>.
- HUD (U.S. Department of Housing and Urban Development). 2021. “FY 2021 ACS 5-Year 2011-2015 Low- and Moderate Income-Summary Data.” <https://www.hudexchange.info/programs/acs-low-mod-summary-data/>.
- Initiative for Energy Justice. 2019. “Energy Justice Scorecard.” <https://iejusa.org/wp-content/uploads/2019/12/Energy-Justice-Scorecard.pdf>.
- IAP2 (International Association for Public Participation). “IAP2 Core Values.” <https://www.iap2.org/page/corevalues>.
- ICCT (International Council on Clean Transportation). 2017. “Expanding access to electric mobility in the United States.” https://theicct.org/sites/default/files/publications/Expanding-access-electric-mobility_ICCT-Briefing_06122017_vF.pdf.
- Kresge (The Kresge Foundation). 2021. “How cities are centering equity in energy benchmarking policies to address climate change.” <https://kresge.org/news-views/how-cities-are-centering-equity-in-energy-benchmarking-policies-to-address-climate-change/>.

- Maciag., M. 2014. "Pedestrian Deaths in Poorer Neighborhoods Report." *Governing Magazine*. <https://www.governing.com/archive/pedestrian-deaths-poor-neighborhoods-report.html>.
- Markey, Ed. 2021. "Senators Markey and Duckworth, Rep. Bush Introduce Legislation to Help Identify Environmental Justice Communities." <https://www.markey.senate.gov/news/press-releases/senators-markey-and-duckworth-rep-bush-introduce-legislation-to-help-identify-environmental-justice-communities>.
- Minneapolis (City of Minneapolis). n.d. "Green Cost Share." <https://www2.minneapolismn.gov/government/programs-initiatives/environmental-programs/green-cost-share/#:~:text=The%20Green%20Cost%20Share%20program%20aims%20to%20create,greenhouse%20gases%2C%20particulate%20matter%2C%20and%20other%20dangerous%20pollutants>.
- Muehlegger, E., and Rapson, D. 2019. "Understanding the Distributional Impacts of Vehicle Policy: Who Buys New and Used Electric Vehicles?" <https://doi.org/10.7922/G21Z42N>.
- MWCOG (Metropolitan Washington Council of Governments). RTDC/EVCharging Stations. <https://gis.mwcog.org/wa/rest/services/RTDC/EVChargingStations/MapServer/>.
- NYSERDA (New York State Energy Research and Development Authority). 2019. "Curb Enthusiasm: Report for On-Street Electric Vehicle Charging." https://www.dot.ny.gov/divisions/engineering/technical-services/trans-r-and-d-repository/C-17-06_Curb_Enthusiasm_Final_Report.pdf.
- NMHC (National Multifamily Housing Council). 2019a. "Household Characteristics." <https://www.nmhc.org/research-insight/quick-facts-figures/quick-facts-resident-demographics/household-characteristics/>.
- . 2019b. "Household Incomes." <https://www.nmhc.org/research-insight/quick-facts-figures/quick-facts-resident-demographics/household-incomes/>.
- Panyam, P. 2020. "3 Ways California Is Taking a Pro-Equity Approach to Electric Vehicles." *The City Fix: World Resources Institute*. <https://thecityfix.com/blog/3-ways-california-taking-pro-equity-approach-electric-vehicles-pallavi-panyam/>.
- Petroni, M. D. Hill, L. Younes, L. Barkman, S. Howard, B. Howell, J. Mirowsky, and M. Collins. 2020. "Hazardous air pollutant exposure as a contributing factor to COVID-19 mortality in the United States." *Environmental Research Letters*. 15 0940a9. <https://iopscience.iop.org/article/10.1088/1748-9326/abaf86/meta>.
- Sallis, J., H. Bowles, A. Bauman, L. Klasson Heggebo, H. Tomten, P. Bergman. 2009. "Neighborhood Environments and Physical Activity Among Adults in 11 Countries." http://www.bridgingthegapresearch.org/_asset/02fpi3/btg_street_walkability_FINAL_03-09-12.pdf *American Journal of Preventive Medicine*. 36(6):484-490. <https://www.ajpmonline.org/article/S0749-3797%2809%2900145-7/abstract>.

SCAG (Southern California Association of Governments). 2020. “SCAG Disadvantaged Communities Planning Initiative: Outreach Best Practices and Equity Framework.” <https://scag.ca.gov/sites/main/files/file-attachments/2020scpdisadvantagedcommunitiesengagementframework.pdf?1605646314>.

Seattle Department of Transportation. 2018. “EVSE Roadmap for Shared Mobility Hubs.” https://www.seattle.gov/Documents/Departments/OSE/ClimateDocs/TE/SDOT_EVSE_Roadmap_for_Shared_Mobility_Hubs.pdf.

Smith, Conner. 2020a. “Nearly 80 percent of VW Funds Remain Two Years After the First Awards” EV Hub. [Nearly 80 percent of VW Funds Remain Two Years After the First Awards – Atlas EV Hub](#)

Smith, David. 2020b. “Electric Mobility for All: Equity Best Practices for E-Mobility Planning.” *GridForward*. <https://gridforward.org/electric-mobility-for-all-equity-best-practices-for-e-mobility-planning/>.

State of Connecticut. 2019. Executive Order No. 3. <https://portal.ct.gov/-/media/Office-of-the-Governor/Executive-Orders/Lamont-Executive-Orders/Executive-Order-No-3.pdf-rel>.

SWEEP (Southwest Energy Efficiency Project). 2018. “Cracking the Code on EV-Ready Building Codes: Among best ways for cities, states to encourage consumers to switch to electric cars.” *SWEEP*. Boulder, CO. <https://www.swenergy.org/cracking-the-code-on-ev-ready-building-codes>.

White House. 2021. “Fact Sheet: President Biden Takes Executive Actions to Tackle the Climate Crisis at Home and Abroad, Create Jobs, and Restore Scientific Integrity Across Federal Government.” <https://www.whitehouse.gov/briefing-room/statements-releases/2021/01/27/fact-sheet-president-biden-takes-executive-actions-to-tackle-the-climate-crisis-at-home-and-abroad-create-jobs-and-restore-scientific-integrity-across-federal-government/>.

Zeger, S., F. Dominici, A. McDermott, J. Samet. 2008. “Mortality in the Medicare population and chronic exposure to fine particulate air pollution in urban centers (2000-2005).” *Environmental Health Perspectives*. 2008 Dec;116(12):1614-9. <https://pubmed.ncbi.nlm.nih.gov/19079710/>.